THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

COLLEGE OF ENGINEERING

Fall 2013

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Charger Engineering

INSIDE THIS ISSUE:

Charger Engineering

The College of Engineering at the University of Alabama in Huntsville publishes news and information on current research, academic programs, and student achievements. To reproduce material contained in this newsletter, please contact the College of Engineering Dean's office at:

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Charger Giving

Friends and alumni of the College of Engineering can have a major impact on our mission by providing financial support and resources that will contribute to the College's strategic research and educational goals. Consider giving to support both undergraduate and graduate student scholarships, to fund faculty endowments, to improve educational programs, and to enhance research facilities.

To learn more about different options for giving to the College of Engineering, please contact the Engineering Dean, Prof. Shankar Mahalingam at Shankar.Mahalingam@uah.edu or 256.824.6474 or the Vice-President for Advancement, Mr. Robert Lyon at Robert.Lyon@uah.edu or 256.824.6501

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Faculty:

The College of Engineering has several open tenure and tenure-track faculty positions. For more information, go to www.uah.edu/engineering and go to Faculty Search 2013. UAH is an affirmative action, equal opportunity institution.

Graduate Students:

The College of Engineering offers M.S.E. and Ph.D. degrees in a broad range of engineering disciplines. College faculty lead strong research programs to support student research projects. For more information on graduate programs, go to www.uah.edu/engineering.

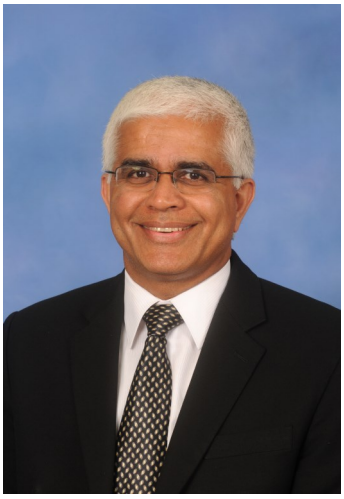
Undergraduate Students:

The College of Engineering offers the B.S. degree in eight ABET-accredited programs: Aerospace, Chemical, Civil, Computer, Electrical, Industrial & Systems, Mechanical and Optical. Undergraduate students have numerous hands-on opportunities including nationally recognized engineering teams, undergraduate research, and the cooperative education and internship programs. For more information go to www.uah.edu/eng/departments/undergraduate-engineering.

Article contributions by Diana LaChance and Jim Steele, UAH Marketing and Communications.

Photo contributions by Michael Mercier, UAH Marketing and Communications

Message from the Dean



There is a great deal of excitement at the UAH campus as our undergraduate and graduate engineering degree programs continue to attract some of the best and brightest students from Alabama and beyond. For the first time in our history, the number of engineering undergraduate students at UAH has climbed beyond 1800. A new scholarship model deployed by the university will enable more entering students to receive financial assistance to pursue their goal of completing an engineering degree. This past year, 282 Bachelors, 126 Masters, and 18 Ph.D. engineering degrees were awarded. We are grateful to the continuing dedication of our outstanding faculty and staff in enabling us to achieve new heights.

The college of engineering continues its focus in pursuing research in the areas pertaining to three of the National Academy of Engineering Grand Challenge problems. These include securing cyberspace, restoring and improving urban infrastructure, and enabling tools for scientific discovery. Two years ago, we initiated a focus on energy storage systems. Starting this year and for the next several years, aerospace and systems engineering will drive our faculty recruitment efforts. In addition, other areas including cyber security and biotechnology promise to provide opportunities in partnership with other academic units on campus.

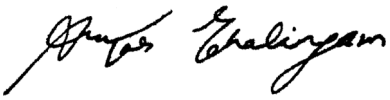
We are particularly delighted to welcome three outstanding faculty members to our College in the areas of unsteady aerodynamics, energy conversion, and systems engineering. You can learn more about them in this Newsletter. Three of our very senior faculty members, Professors John Gilbert (MAE), Carol D. Johnson (ECE), and Nagendra Singh (ECE) have retired and have been named emeritus faculty. We are very grateful to them for their career long contributions in research, education, and service.

On November 20th, 2013, ChargerSat -1, a 4-inch, 2.2 pound cubesat proposed, designed, built, and tested by our Space Hardware Club was successfully launched into space via a Minotaur 1 launch vehicle from NASA's Wallops Flight Facility in Virginia. This is an incredible milestone achieved by our students. Team UAH placed 2nd out of 26 universities in the 2013 ACSCE Southeast regional concrete canoe competition in Miami, Florida. Our students continue to thrive and excel as members of various professional organizations.

Featured in this newsletter are stories about some of our distinguished alumni. Former NASA astronaut, Jan Davis (MS 1983, PhD, 1985) continues to inspire generations of our students. UAH alum Lori Bruce (BSE 1991, PhD 1996) was recently named Dean of the Graduate School and Associate Vice President for Academic Affairs at Mississippi State University. She is the first woman to lead MSU's graduate school.

These are just a few examples of the amazing activities and accomplishments featured in our third *Annual College of Engineering Newsletter*. Once again, I am pleased to express our appreciation for the strong support we enjoy from our University leadership, academic colleges and research centers on our campus, the Huntsville community, federal, state, and corporate research and scholarship sponsors, our students and their families, our alumni, and our friends of the College and University.

Best regards,



Shankar Mahalingam

Dean and Professor of Mechanical and Aerospace Engineering

December 2013

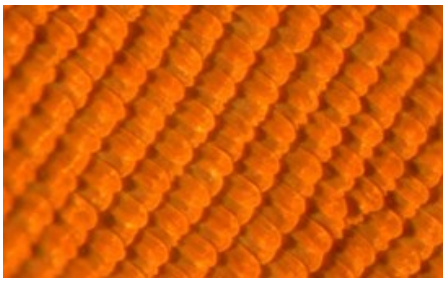
Aerodynamics and Butterflies
Improving Efficiency

Prof. Nathan Slegers
UAH MAE Dept.

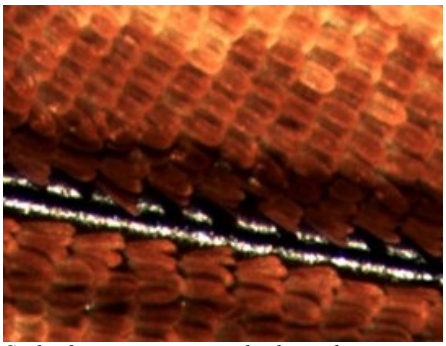
Professor Nathan Slegers and his colleague at the University of Alabama in Tuscaloosa, Professor Amy Lang, are beginning an investigation that may lead to the discovery of a new passive surface drag control methodology derived from butterfly scales functioning at the micro-scale level. The work is funded by a new National Science Foundation grant shared by the two universities. The scales covering butterfly wings create a unique micro-pattern resulting in a surface drag alteration. The investigation will determine if a local surface drag alteration results in reduced energy requirements for butterflies in flapping and gliding flight.

Butterflies, like this Monach specimen, have characteristics much closer to practical micro air vehicles, namely reduced wing beat frequencies, low aspect ratios, and large wing area to body mass ratios. An area of interest is how the flight kinematics and butterfly morphology are used to increase function.

The team will measure aerodynamic efficiency of butterfly wings through flight testing of live Monarch specimens in the **MAE Department's Autonomous Tracking and Optical Measurement (ATOM) Laboratory**. The facility uses 33 infrared cameras that each capture up to 370 image frames per second. The system allows three-dimensional millimeter-scale tracking of infrared reflective markers over a room-sized flight volume. In work leading to the new grant, Professors Slegers and Lang used the ATOM Lab to record the details of live butterfly flight in a volume of 4m x 7m x 6m. This fundamental research may lead to butterfly-inspired surface micro-patterning for aircraft wing systems and other engineering applications.



Top view of Orange Monarch scales.



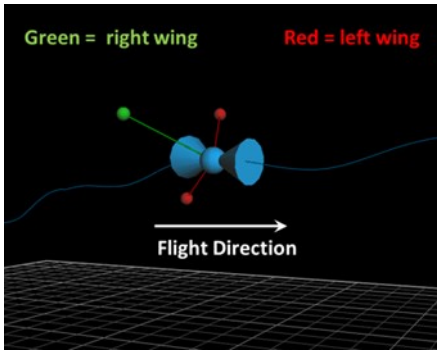
Scales from in rows perpendicular to the veins on the wing.

Scales seen in a cut through the wing.

Professor Slegers joined the MAE Department at UAH in 2005 after earning his BS in Mechanical Engineering from the University of Washington in 2000 and the MS, and Ph.D. in Mechanical engineering from Oregon State University in 2002 and 2004, respectively.

For more information: www.eng.uah.edu/~slegers/ATOM.html or email Prof. Slegers at nathan.slegers@uah.edu.

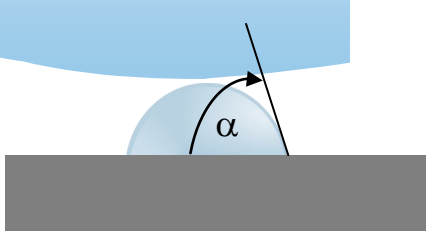
Infrared reflective markers are attached.



Computer model to study flight dynamics.

Attraction is All About the ANGLES

Prof. Ramon Cerro
UAH CME Dept.



Originally from Argentina and a Professor of Chemical Engineering at UAH, Professor Cerro, does basic research into making stable and long-lasting bonds between dissimilar materials. He is fascinated by why some coatings and surfaces find each other attractive while others face rejection.

"The surface has to be wet for adhesion, and the way you wet it matters," said Professor Cerro in summing up his invited review on contact angles and adhesion, done in collaboration with Professor M. Elena Diaz of the Universidad de Salamanca in Spain and Professor Michael D. Savage of Leeds University in England.

"Wetting precedes adhesion, and the goal is not to entrain air in the coating process." In their paper (*Convertech*, **2** (6), pp. 62-69, 2012), the trio explains how drop contact angles interact with hydrophobic and hydroscopic substrates and capillary action. "The contact angle is what really counts," said Professor Cerro, "What the contact angle is telling you is that there is an attraction between the coating and the solid material."

Broadly defined, contact angle is the measurement of the angle at which the sides of a drop meet on a surface. It has a direct impact on wetting which affects the adhesion of the coating. For example, a windshield coated with a rain repellant film maximizes the contact angle, which minimizes the raindrop's adhesion and they run off in drops. For an untreated windshield, raindrops adhere better because the contact angle is minimized, allowing the capillary action of the glass to have greater effect, and the water runs off in sheets.

Professor Cerro, a member of the National Academy of Engineering of Argentina, said he has been "working in the area of interfacial contact for 40 years." In that time, he has seen it advance to where a single-molecule thick coating can be uniformly applied. Like so much of what he studies, single-molecule coatings take their cue from nature. "Look at an abalone shell," said Professor Cerro. "What you are seeing, nature made one layer at a time, and that layer was only one molecule thick. This is how nature builds things, one molecule layer at a time."

Asking questions about the natural world has led to breakthroughs. "One of the puzzles that is still not resolved is why can a tree grow to be taller than 10 meters?" Professor Cerro asks. "The limit of capillary action, as far as the effect of gravity and the atmosphere is 10 meters. If you have a larger column of water under its weight, there will be places where pressure would be, apparently, negative. Yet trees grow taller than that." A possible explanation is that trees use a natural capillary rise effect that happens in the presence of a wedge or corner angle to boost fluid and nutrients beyond 10 meters. "When you have a wedge, the water will rise indefinitely," Professor Cerro says. The wedge angle itself draws the fluid up. This observation led to the development of glass capillaries to measure very small liquid contact angles inside capillaries of square cross sections.

Professor Cerro received his Ph.D. in Chemical Engineering from the University of California, Davis in 1970. He served on the faculty at the University of Litoral in Argentina and the University of Tulsa prior to his appointment at UAH in 1997.

For more information: www.uah.edu/eng/departments/cme/welcome or email Prof. Cerro at ramon.cerro@uah.edu.

Making Structures

SAFER

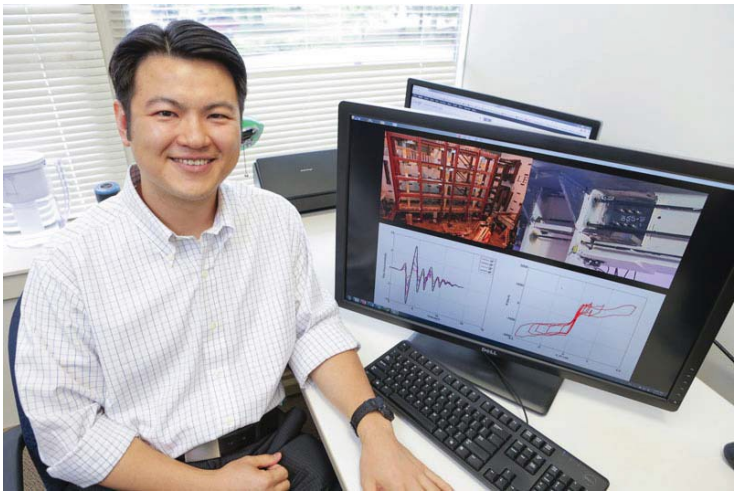
Photograph of Chi Chi earthquake damage 1999 from http://www2.rcep.dpri.kyoto-u.ac.jp

When Assistant Professor Ying-Cheng Lin was an undergraduate majoring in structural engineering in Taiwan, he knew that his studies would one day help him land a good job. But he never realized they would also save his life. “In 1999, a very big earthquake hit Taiwan,” says Professor Lin. At the moment of impact, Lin was home with his girlfriend - now wife - and their dog. “I thought I was going to die,” he says. “But I knew where to go because I was a structural engineer. So we hid next to the column.” They were the lucky ones. Ultimately, he says, the 90-second Chi-Chi earthquake left almost 3,000 dead and more than 40 buildings collapsed. It was a transformative experience.

Professor Lin shifted his research focus to developing new techniques to make steel structures safer and more earthquake-resistant. And after graduating with his bachelor’s and master’s degrees from National Taiwan University, he started working at Taipei’s National Center for Research on Earthquake Engineering. Shortly thereafter, he learned of another project at Lehigh University investigating self-centering (SC) damage-free seismic-resistant steel frame systems, an innovation with the potential to withstand even the most destructive earthquakes. Professor Lin had found his niche and soon joined the Lehigh research team working on the SC steel frame systems. Their goal was to not only build a successful seismic-resistant damage-free structural system, but also understand the system’s seismic response and create design procedures that could be applied or retrofitted to buildings in earthquake-prone areas.

Professor Lin and his fellow researchers began by looking at what worked - and what didn’t work - in conventional systems. One problem they identified was in the connection between the structure’s components. “In conventional systems, a structure’s beams are fixed to its columns, so if they deform or rotate as a result of an earthquake, they are damaged,” says Professor Lin. “But in this system, a pre-stress method is used to compress the beam to the column, so if it rotates, there is a gap.” Another issue was the friction damper device, which is used to carry a structure’s gravitational and lateral loads and limit friction between surfaces.

In conventional structures, the damper is located at the ends of the beam. But Professor Lin and his team changed its placement to the beam's web, to avoid interference with the floor slab's construction and to dissipate the energy during the opening and closing of the gap in the connections.



Professor Lin, UAH CEE Dept.

Finally, they added a 4-inch annealed steel tube with wooden disks, or fuse, to the end of the post-tensioning elements. "Post-tensioning elements are critical members; if they break or yield, the system will fail," he says. "So a fuse will give it leeway, and a crushed fuse will let us know upon inspection that the structure was close to yield point." Once all of these innovations were in place, Professor Lin and his fellow researchers built a full-size, four-story, two-bay frame and tested it in a simulation laboratory equipped to generate multi-directional static and time-varying loads on large-scale structures. "We connected four hydraulic actuators to the frame to replicate an earthquake, and then simulated 25 earthquakes at three different levels to study the reliability of the system," says Professor. Lin. "The first level was a frequently occurring earthquake, the second was a design basis earthquake, and the third was a maximum considered earthquake."

Unlike the self-explanatory frequently occurring earthquakes, design basis earthquakes are based on a 10% probability in 50 years and tend to result in permanent lateral displacement in traditional structures. By contrast, maximum considered earthquakes like the Chi-Chi one that Professor Lin lived through are based on a 2% probability in 50 years and tend to collapse conventional structures.

So how did the SC steel frame perform? "During the frequently occurring earthquakes and design basis earthquakes, there was no damage to the beams or connections," says Professor Lin. "And during all three levels of earthquakes, there was no permanent lateral displacement because the frame self-centered."

The 4-inch annealed steel tube with wooden disks, or fuse, is designed to be crushed before the post tensioning elements their strength.

It was a significant accomplishment, challenging conventional approaches to the design and construction of earthquake-resistant structures. And not just earthquake-resistant ones, points out Professor. Lin. Here in Huntsville, for example, the technology can be used to limit or even prevent tornado damage. Prof. Lin is currently investigating technologies to develop better designs that may be integrated into existing structures. The Alabama Department of Transportation, that manages bridges and other civil structures, could benefit from this improved structural integrity and reliability.

Professor Lin earned his BS in Civil Engineering and MS in Structural Engineering from the National Taiwan University and then his Ph.D. in Civil Engineering from Lehigh University in 2012.

For more information: www.uah.edu/eng/departments/cee/welcome or email Prof. Lin at yingcheng.lin@uah.edu.

Next Generation Trace Compressions Methods

Prof. Aleksandar Milenkovic
UAH ECE Dept.

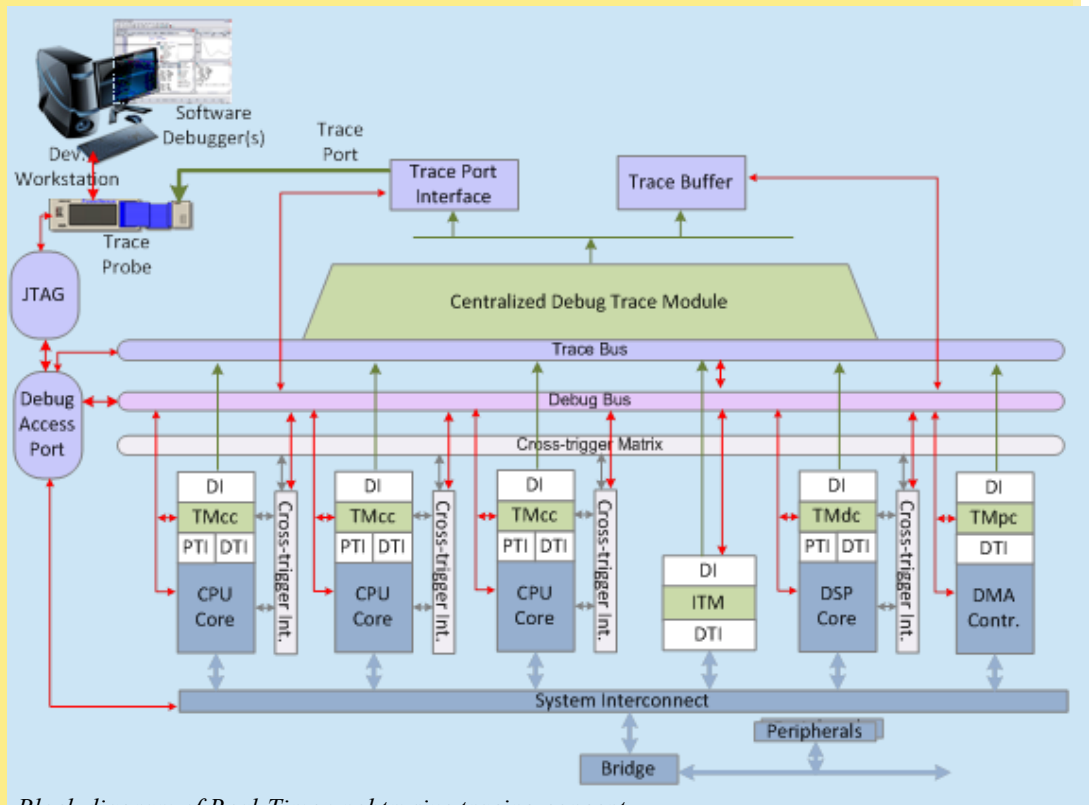
Our society increasingly relies upon embedded computer systems that have become essential to all aspects of our lives. Faster, cheaper, smaller, more sophisticated, and more power-efficient embedded computer systems spur new applications that require very complex software stacks. The growing software and hardware complexity and tightening time-to-market deadlines make software development and debugging the most critical aspect of embedded system development. A recent study found that software developers spend between 50%-75% of their time debugging programs, yet the nation still loses approximately $20-$60 billion a year due to software bugs and glitches. The recent shift toward multicore architectures makes software development and debugging even more challenging. Traditional debugging is time consuming and may interfere with program execution, causing some bugs to become irreproducible and making it unusable in real-time environments.
Moreover, tracing a processor's internal state during execution is only feasible for short program segments and requires large on-chip buffers or wide trace ports, either of which increases system cost and limits scalability.

Professor Aleksandar Milenkovic of the Electrical and Computer Engineering Department at UAH was awarded a grant from the National Science Foundation titled "Real-Time Unobtrusive Tracing in Multicore Embedded Systems". This project involves developing the next generation of trace compression methods and infrastructure to make continuous, real-time, unobtrusive, and cost-effective program, data, and bus tracing possible in embedded systems. The approach relies on on-chip hardware to record the processor state and corresponding software modules in the debugger. The novel insight is that a sequence of trace records can be translated, without loss of information, into a much shorter sequence of miss events using small hardware structures. The few remaining miss events are then further compressed using highly-effective yet simple-to-implement encoding schemes, yielding heretofore unseen compression ratios.

The new tracing and debugging hardware resources can help programmers find difficult and intermittent software bugs faster, thus improving productivity. For example, reducing debugging time by just one percent amounts to hundreds of millions of dollars annually in saved salaries, with a concomitant reduction in software cost and time-to-market. Moreover, higher quality software may eliminate errors in medical, automotive, or mission-critical devices and thus save lives.

Professor Milenkovic received the Ph.D., M.S., and Dipl. Ing. degrees from the University of Belgrade, Serbia in 1999, 1997, and 1994, respectively.

For more information: www.ece.uah.edu/~milenka/npage/index.php or email Prof. Milenkovic at aleksandar.milenkovic@uah.edu.



Block diagram of Real-Time unobtrusive tracing concept

Manned/Unmanned Collaborative Systems Integration Laboratory

UAH and faculty from the Industrial and Systems Engineering and Engineering Management (ISEEM) Department have joined with the Army to build a new Manned/Unmanned Collaborative Systems Integration Laboratory in Olin B. King Technology Hall on the UAH campus.

The culmination of efforts that began in 2009, the lab is a UAH/Army partnership and was built for the cost of materials alone by the America's Army Game Studios. The new lab will utilize data collected from UAH student players, who have grown up with video games, to develop warfighter systems to build effective teaming, decision making and performance.

Real-time information will be provided by various means to students in gamed combat situations while they are in the presence of psychological and physiological stressors. Their reactions will be tested and the information gained will be applied to systems that will promote warfighter cohesiveness.

The lab is also intended to support UAH in its efforts to gain National Science Foundation grants for related research. The knowledge base gathered will be shared between the university and the military. Another goal of the lab is to explore efficient and productive ways to enfold operation of unmanned aerial vehicles and ground-based robotic systems into forces operating on the ground through manned/unmanned teaming.

Professor Sampson Gholston of the ISEEM department is the primary faculty researcher from the College of Engineering for this effort.

For more information email Prof. Gholston at sampson.gholston@uah.edu.

UAH President Robert Altenkirch tours the Systems Integration Laboratory

New Research Appointments

Prof. Robert Frederick
UAH MAE Dept.

Professor Robert Frederick has been named Director of the UAH Propulsion Research Center after a stint as interim Director. A celebrated example of the Center's educational activities is the University Student Launch Initiative. This activity is in part responsible for the Center being named by *Popular Science* magazine as a "Most Awesome Lab" in 2010 and 2011 as part of its "Best Places to Pursue Science" feature and as "Home base for some of tomorrow's great rocket scientists" in the "Labs That Go Boom" feature in 2012.

Professor Frederick received his Ph.D. in Aeronautics and Astronautics from Purdue University in 1988, and he joined UAH in 1991. He is an Associate Fellow of the AIAA and former chairman of the AIAA Hybrid Rocket Technical Committee. He has been a technical advisor to NATO in the area of solid propulsion.

For more information: www.uah.edu/prc or email Prof. Frederick at robert.frederick@uah.edu.

Prof. Robert Lindquist
UAH ECE Dept.

Professor Robert Lindquist has been named Director of the Center for Applied Optics (CAO). Professor Lindquist is also Chair of the Electrical and Computer Engineering Department at UAH. CAO has research funding on average of $2 to $3 million per year from agencies like NASA, the U.S. Army and several industrial partners including Ball Aerospace.

CAO recently completed testing on the primary mirror segments for the James Webb space telescope CAO will support testing the entire mirror assembly in Houston in 2014.

Professor Lindquist received his Ph.D. in Electrical Engineering from Pennsylvania State University in 1986, and he joined UAH in 2003.

For more information: www.uah.edu/cao or email Prof. Lindquist at robert.lindquist@uah.edu.

New Faculty Spotlight

Paul Collopy was appointed Professor and Chair of the Department of Industrial and Systems Engineering and Engineering Management (ISEEM) in October 2013. Previously, Prof. Collopy served as Program Manager at the National Science Foundation managing engineering design and systems engineering programs, as the Deputy Director of the Center for Systems Studies at UAH and as Research Professor in the ISEEM department. Prof. Collopy worked as an engineering economist and executive director at the Value-Driven Design Institute where he researched and advised on complex system design, technology evaluation, and research management for the Department of Defense, the Federal Aviation Administration, and the White House Office of Science and Technology Policy. He is an Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA).

Prof. Collopy earned his B.S. in Electrical Engineering and Ph.D. in Engineering Economic Systems, both from Stanford University.

For more information email Prof. Collopy at paul.collopy@uah.edu.

Chang-Kwon Kang was appointed Assistant Professor of Mechanical and Aerospace Engineering in August 2013. Prior to UAH, he served as a post-doctoral fellow in the Department of Aerospace Engineering at the University of Michigan, Ann Arbor. His research interests are in flapping-wing unsteady aerodynamics, locomotion of biological and robotic flyers/swimmers, energy harvesting systems, fluid-structure interaction in wind turbines and blood flow, and high-performance computing. He is a co-author of an upcoming Cambridge University Press book An Introduction to Flapping Wing Aerodynamics.

Professor Kang earned his BS and MS degrees in Aerospace Engineering from the Delft University of Technology in the Netherlands, and his Ph.D. in Aerospace Engineering from the University of Michigan, Ann Arbor, in 2011.

For more information email Prof. Kang at chang-kwon.kang@uah.edu.

Yu Lei was appointed Assistant Professor of Chemical and Materials Engineering. His doctoral research was partly carried out at the Fritz Haber Institute of Max Planck Society in Germany. The work involved experimental studies of model catalysis with the aim to build precise structure-reactivity relationship. Most recently, Professor Yu worked as a postdoctoral researcher in the Energy Systems Division at the Argonne National Laboratory. His research focus was in applying atomic layer deposition (ALD) to prepare nanostruatured materials for energy conversion and storage. His research interest include the development of new techniques and processes for a wide variety of applications such as nanoelectronics, catalysts, batteries, solar cells and other energy technologies.

Professor Lei received his B.S. in Chemical Engineering from Nanjing University in China in 2004, and Ph.D. degree in Chemical Engineering from University of Illinois at Chicago in 2010.

For more information email Prof. Lei at yu.lei@uah.edu.

MAE Assistant Professor George Nelson has received a Ralph E. Powe Junior Faculty Enhancement Award from the Oak Ridge Associated Universities, a consortium of 109 major Ph.D.-granting universities. The Powe Award supports the research and professional growth of young faculty and is one of 30 given nationwide this year. It will support Prof. Nelson's research on the stability of thermoelectric materials at high temperatures.

Email Prof. Nelson at geoge.nelson@uah.edu

MAE Professor Francis Wessling was elected Fellow of the American Society of Mechanical Engineers (ASME). ASME Fellows are recognized for outstanding engineering achievements as described by senior members of the Society. Prof. Wessling has twice served as Department Chair, and his research career has spanned a number of areas including solar energy research and education, materials in microgravity and the development of research-grade sounding rockets. Prof. Wessling served as the Associate Director and Chief Engineer of the Consortium for Materials Development in Space, a UAH research center from 1985 – 1999. His leadership was instrumental in bringing $50,000,000 to UAH to support materials research in microgravity. Through his work, we better understand the advantages and challenges of materials handling and growth in microgravity environments.

Email Prof. Wessling at francis.wessling@uah.edu

CME Professor Michael Banish has been awarded $176,480 from Dow Corning Corporation for experimental analysis. The scope of this work will be to determine a range of thermophysical properties of molten silicon with selected transition metal components. The thermophysical properties include the 1) density and thermal expansion coefficient, 2) the viscosity and surface tension, and 3) the specific heat-hemispherical total emissivity ratio. These measurements are to be performed using the High Temperature Electrostatic Levitator (ESL) at Marshall Space Flight Center (MSFC) in Huntsville, Alabama.

Email Prof. Banish at r.banish@uah.edu

MAE Assistant Professor Babak Shotorban received the 2013 Outstanding Junior Faculty Award of the College of Engineering. Prof. Shotorban's research includes stochastic modeling and higher-order numerical methods in computational fluid dynamics, the physics of particle-laden and droplet-laden flows, turbulence, fires and dusty plasmas. His current projects are concerned with fire initiation and propagation in sparse vegetation, the effects of heating mechanisms and moisture content on ignition of live fuels, stochastic charging and dynamics of dust particles in plasmas and transport of particulates in oil-spill events. His research has been supported by the National Science Foundation and the US Department of Agriculture.

Email Prof. Shotorban at babak.shotorban@uah.edu

CME Professors C.P. Chen and Banish received a $60,000 award from a Phase II CFDRC DOD/ SBIR for the development of novel high performance propellant and $295,000 from a DOD/Polaris STTR Phase II for low temperature smoke effort. The Department of Defense is interested in understanding and developing munitions that have improved storage characteristics. These characteristics include maintaining performance after long-term storage and developing a wider range of acceptable storage conditions.

Email Prof. Chen at chien-pin.chen@uah.edu

A company hatched as a partnership between The University of Alabama in Huntsville and **CME Professor Krishnan Chittur** is in the design phase for a device that can provide physicians one-hour pathogen testing capabilities.

Prof. Chittur is a cofounder of GeneCapture, a resident company at the HudsonAlpha Institute for Biotechnology in Huntsville, AL. The company was formed to pursue the commercialization of the technology patented by Prof. Chittur and three other scientists. GeneCapture has proven its patented technique in the lab and is now developing an automated prototype for higher throughput testing. The product involves unique DNA probes that "capture" a genetic signature quickly, and thus can be used to identify the presence of one of many specific pathogens in a sample, be it human, plant, food or animal. The company has recently collaborated with Huntsville Hospital in a validation study using human samples.

Email Prof. Chittur at krishnan.chittur@uah.edu

College of Engineering: Alumni Pride

Dr. Jan Davis
UAH alumna & former NASA astronaut

"The contests they (UAH) have, like the Moon Buggy Race, the Mini-Baja Competition, and Concrete Canoe Competition, are really good activities for students so that they can apply what they learn in school." - *Dr. Jan Davis, Alumna*

Dr. Jan Davis on UAH, Space, and Tomorrow's Astronauts

When Dr. Jan Davis was growing up in Huntsville in the 1960s, there simply were no women astronauts. So it wasn't something the UAH alumna ever considered becoming. But in 1978, when the first female candidates were selected to be part of NASA's Astronaut Corps, Dr. Davis began to rethink her career path and in 1984, while working as an aerospace engineer at NASA Marshall Space Flight Center (MSFC) and attending UAH, she applied to be an astronaut. Since becoming an astronaut in 1987, she has logged more than 673 hours in space over three flights.

Born in Florida, Dr. Davis moved with her family to Huntsville when she was in elementary school. She attended Huntsville High School, graduating in 1971 and then went on to earn BS degrees in applied biology from the Georgia Institute of Technology and in mechanical engineering from Auburn University. She then moved to Texas, where she worked for Texaco as a petroleum engineer in tertiary oil recovery. Two years later, she returned to Huntsville to work for NASA MSFC and to pursue her graduate degree at UAH.

Attending graduate school was always part of Dr. Davis' plan. Between working and studying, Dr. Davis says she wasn't able to enjoy the college experience beyond attending the occasional hockey game, but she was able to receive a practical mechanical engineering education that went beyond the textbook. "My advisor was working with the Army so he knew what we needed from a practical standpoint for our jobs," she said. "So it was good theory and also good application. It is important to have that real world experience."

It was after finishing her master's degree that Dr. Davis applied to be an astronaut. When she was selected for an interview, she says, "I made it my goal to finish my Ph.D. and become an astronaut. To be competitive, you really need it."

Dr. Davis notes she was able to use many of the things she learned at UAH during her time in space. "Over the three flights we had a lot of medical, materials, and robotics experiments," she says. "It was hard work! We were up there for a reason and we didn't have a lot of time to just look out the window."

Her graduate work also helped her communicate with the scientists who had experiments on her spaceflights. "When you're on a mission and you're working with scientists, they respect your ability more when you have a PhD," she says. But she did find time to cut loose. "Weightlessness was fun!" she says with a laugh. "My mom said I looked like I was right at home and that's how I felt – like I belonged there."

In 2005, after going on to serve as MSFC's director of Safety and Mission Assurance, Dr. Davis retired from NASA. Currently, Dr. Davis is the vice president and deputy general manager of Jacobs Engineering and Science Services and Skills Augmentation Group. "I oversee nearly 700 employees who support various MSFC programs and projects," she says. "So it's a good way to still stay with NASA!"

As for what she'll do next, Dr. Davis says she doesn't know for sure. But whatever it is, it will involve helping our nation's youth learn about careers in the fields of science, technology, engineering, and math – especially our young women.

And if that means inspiring them to become an astronaut, just as Dr. Davis was inspired by the women astronauts who came before her, "even better," she says, "because I can share that with them." She does have one piece of advice for them, however.

"Rather than going into a particular field or working somewhere just to be an astronaut, you should find something you are really passionate about and love," she says. "Because you'll do your best at things you are passionate about."

Dr. Lori Mann Bruce leads Graduate Education at Mississippi State University

Prof. Lori Mann Bruce

In May 2013, Dr. Lori Mann Bruce (BSE 1991, Ph.D. 1996) was named Dean of Graduate Studies and Associate Vice President for Academic Affairs at Mississippi State University (MSU). She will be the first woman to ever lead the MSU's Graduate School which has nearly 4,000 students.

Prior to this appointment, Dr. Bruce served as the associate dean of the Bagley College of Engineering at MSU. She is also a William L. Giles Distinguished Professor, the highest faculty rank at MSU.

Dr. Bruce received her BSE in Electrical Engineering in 1991. She earned her doctoral degree in Electrical Engineering in 1996 under the guidance of Professor Reza Adhami. Her research expertise is in the area of digital and signal processing with an emphasis on hyperspectral remote sensing and diagnostic medical imaging.

Chris Orr receives Prestigious General Electric Edison Award

Chris Orr

In fall 2012, Mr. Chris E. Orr (BSE 1984), was awarded a General Electric Edison Award for his contribution to the General Electric (GE) Company. The Edison award is named after Thomas Edison, one of the founders and the most prolific inventor in history. Mr. Orr, who is a principal engineer for GE Intelligent Platforms Mil/Aero in Huntsville, leads a technology group in new product introductions such as the Intel Based single-board computers.

As an Edison award recipient, Mr. Orr is given the opportunity to select a university of his choice to receive a $25,000 grant to fund research. He chose to direct this grant to the Electrical and Computer Engineering Department at UAH. The grant will be used to fund undergraduate students interested in conducting research in embedded computing.

Mr. Orr received the BSE in Electrical Engineering in 1984 from UAH. He was a member of the UAH men's basketball team from 1979 to 1984.

Barbara Rodkey Lehman to serve as President of Alabama of ASCE

Barbara Rodkey Lehman

Barbara Rodkey Lehman (BSE 2003) will serve as the 2013-2014 American Society of Civil Engineers (ASCE) President for the Alabama section. She has been an active ASCE member where she is currently serving as President- Elect of the Alabama section. Ms. Rodkey Lehman also chaired the committee for the 50th Anniversary of the Huntsville Branch of ASCE this past spring. She was also recognized as ASCE's Civil Engineer of the Year by the Huntsville Branch.

A Huntsville native, Ms. Rodkey Lehman has BA degrees from Huntingdon College in early and elementary education. After a couple of years teaching and accompanied by her love for science and math, she came to UAH to earn a degree in Civil Engineering. She graduated with honors, receiving a BSE in Civil Engineering in 2003. She is an employee of GEO Solutions and has served as a Project Engineer with them for the last ten years. Her role as Project Engineer has given her the opportunity to manage multimillion dollar projects in Alabama, Tennessee, Mississippi, Georgia and Kentucky.

College of Engineering Retirements

Prof. C. D. Johnson

Distinguished Professor C. D. Johnson of the Electrical and Computer Engineering Department is arguably one of the most internationally recognized professors to serve at UAH. Prof. Johnson joined the (then) Electrical Engineering Department as an Associate Professor in 1963 after earning his Ph.D. from Purdue University. At that time, UAH was just a one building campus and department meetings were held in Tuscaloosa. His initial assignment was to create and teach a broad array of new graduate-level courses in advanced modeling, simulation, and control to support the Engineering Staff at the U.S. Army Missile Command. Prof. Johnson is most recognized for his research in new theories and methods for designing high performance guidance and control systems for challenging aerospace and missile applications. The phrase "Disturbance-Accommodation Control" was coined by Prof. Johnson in his original papers and his pioneering research led to rapid growth of scholarly work and international conferences related to this field of control.

Prof. N. Singh

Distinguished Professor Nagendra Singh has over 25 years of service to UAH and over 40 years of experience in modeling and simulation of electromagnetic and plasma systems. In 1970, he received his Ph.D. in Electrical Engineering from the California Institute of Technology. Prof. Singh joined the Electrical and Computer Engineering Department at UAH in 1986. During his tenure at UAH, he has contributed to the field of space plasma research through particle simulation of complex plasma processes such as antennas in plasmas, formation of electric double layers, waves and instabilities, large-scale plasma flow and charging of spacecrafts. Using a fully 3-D parallel PIC (Particle–in-Cell) code, Prof. Singh led the work at UAH on the nonlinear evolution of fast lower hybrid waves in space plasmas. This work contains the first fully kinetic treatment of nonlinear evolution of the parametric instabilities driven by fast lower hybrid waves in space.

Prof. J. Gilbert

Professor John Gilbert retires with over 25 years of service to UAH. He earned a Ph.D. in Mechanics from the Illinois Institute of Technology in 1975. He joined the Department at the rank of Professor in 1985 and served as Director of what was then the Civil Engineering Program from 1986-1990. Over his career, Dr. Gilbert supervised 14 Ph.D. dissertations, 39 MS and 8 BS theses. His publications include two book chapters, three patents, 67 journal articles and 132 conference proceedings. Dr. Gilbert is a fellow of the Society for Experimental Mechanics and is a founding member of the American Academy of Mechanics and of ASCE's Engineering Mechanics Institute. His research has been recognized nationally by such honors as ASCE's Engineer of the Year Award, the Fellowship Award from the American Society for Nondestructive Testing and awards from NASA and the AIAA for pioneering work in the areas of radial metrology, fluid flow visualization and panoramic imaging in space.

Other Highlights

Dr. James E. Smith, Jr. served as a Southern Regional Safety Coordinator for the AICHE CHEM-E car Regional Competition this year. Individuals are selected due to their outstanding service to AICHE and to help ensure a safe competition for the student teams. Duties of the Regional Safety Coordinator are as follows: work with the host school faculty representative to ensure all chemicals are safely handled and disposed, review the completed EDP online reviews and evaluate the competing schools in each region for safety and rule compliance on competition day, communicate with the National Safety Coordinator regarding issues of safety and questionable practices by students, act as final authority to disqualify a student team onsite if safety of students or other participants is compromised, and report results of the competition.

A team of MAE Capstone Design students designed, fabricated and tested a microgravity stowage and rack system for a Deep Space Habitat concept module at Marshall Space Flight Center. The final system was installed at Marshall in April 2013. Two team members presented the results of the project at the International Astronautical Congress in Beijing, China, in September 2013. The project included an outreach to middle school and high school students throughout North Alabama. High-school students at the Huntsville Center for Technology developed computer-aided design models of the early design and built a mock-up of the system. The $54,000 project was directed by capstone design coordinator **Dr. Christina Carmen** and was funded by the National Space Grant Foundation, the Alabama Space Grant Consortium and UAH. Fabrication was supported by Watring Technologies in Huntsville.

Jacqueline M. Marriott, alumna of University of Alabama in Huntsville was awarded the prestigious 2013 ASCE Daniel W. Mead Prize for Younger Members. She was invited to receive the award at Society's Annual Conference Leadership Breakfast held at Charlotte, NC on October 11, 2013

Charger Engineering Student Highlights

UAH Space Hardware Club Satellite Launch in Virginia

The UAH CubeSat, ChargerSat-1, was launched into space on November 19th. The craft was designed and constructed by the UAH Space Hardware Club, a student-run College of Engineering organization. The core team includes MAE students and brothers, Mark and Eric Becnel, and ECE students Matt Rodencal and Mason Manning. The 4-inch, 2.2 pound satellite was first proposed in 2008, and in 2010 its mission was finalized. In 2011, the team was accepted for NASA's CubeSat Launch Initiative, a program which launches small satellite payloads on NASA rockets. The team received critical assistance from partners across the Rocket City: requirement testing at NASA's Marshall Space Flight Center, electronics assembly at STI Electronics and rocket preparation at Wyle Labs. To assure proper operation in microgravity, technologies such as its gravity gradient stabilization system and its four deployable solar panels were tested during short periods of near-zero-gravity aboard NASA's G-Force One airplane based at Ellington Field in Houston.

The ChargerSat-1 satellite is ready for spaceflight.

ChargerSat-1 was one of a stack of more than two dozen CubeSats launched aboard a Minotaur 1 at NASA's Wallops Flight Facility at Wallops Island, VA. The team will stay in contact using information sent via radio transceivers and other data collection devices.

UAH Concrete Canoe Team Finishes Second in Miami

The concrete canoe team from the University of Alabama in Huntsville finished second out of 26 universities competed in the Southeastern Regional at Miami. Team UAH finished first in the design paper and the final product as well as in second place in the women's endurance race, men's endurance race and in the plan reading/ transportation competition and third in the surveying competition. To date, team UAH has proudly represented the Southeast Region sixteen times at the national level. They have five national wins and three second place finishes.

UAH Concrete Canoe Team.

UAH ChemE Car Competition Finishes Seventh in Kentucky

In April 2013, undergraduate students from the UAH chapter of the American Institute of Chemical Engineers (AICHE) participated in the regional ChemE Car competition held at Kentucky University. UAH bases the design of the Watter-Bug on hydrogen fuel cell technology. The motor on the Watter-Bug is a DC-Micromotor Series 3863-024C which has high efficiency ball bearings and low friction carbon brushes and has been machined to interface with the body of the Watter-Bug. The Watter-Bug will stop its motion once the hydrogen supplied to the fuel cell is exhausted. They placed 7th in the competition.